EFFECT OF CLIMATE AND SEASON OF BUNDELKHAND REGION ON URINARY STONES

THESIS

FOR

MASTER OF SURGERY

(GENERAL SURGERY)

BUNDELKHAND UNIVERSITY
JHANSI (U. P.)

1991 DEV RAJ SINGH

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C E R T I F I C A T E

This is to certify that the work entitled " EFFECT OF CLIMATE AND SEASON OF BUNDELKHAND REGION ON URINARY STONES" has been carried out by the Dr. Dev Raj Singh, himself in this department.

He has put in the necessary stay in the department as required by the regulations of Bundelkhand University.

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Dated: 29/11/90

C E R T I F I C A T E

This is to certify that the work entitled " EFFECT OF CLIMATE AND SEASON OF BUNDELKHAND REGION ON URINARY STONES ", which is being submitted as thesis for M.S.(General Surgery) examination, 1991 of Bundelkhand University by Dr. Dev Raj Singh, has been carried out under my guidance and supervision. His observations and results have been checked by me from time to time.

This work fulfills the basic ordinances governing the submission of thesis laid down by Bundelkhand University.

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Professor and Head,
Department of Surgery,
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Jhansi (U.P.)

Dated: 29/11/90

(GUIDE)

A C K N O W L E D G E M E N T

No words can express the gratitude for the contribution of our respected teachers for their valuable suggestions and their loving and helpful attitude.

I wish to express my gratitude for having been associated with Prof. S.L.Agarwal, M.S.,F.R.C.S., Professor and Head, Department of Surgery, M.L.B.Medical College, Jhansi. I am really very lucky to have had an opportunity to work under him. His fatherly attitude valuable suggestions and constant inspiration helped me to work out and to continue the effort to find out epidemological factors in the causation of urolithiasis.

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(DEV RAJ SINGH)

Dated: 29.11.90

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INTRODUCTION

INTRODUCTION

Anthropologic history provides evidence that urinary calculi existed as long as 7000 years ago and perhaps more. The recognition of different varieties of urinary calculi also resulted in more varieties of medical treatment. During the last decade however, many major advances have greatly improved our under standing of the causes of stone disease. Although not all calculi can be cured, patients who develop one of the five major types of urinary calculi now have atleast a 50 percent chance of cure or control with medical therapy alone. Surgery continues to be important as one aspect of treatment of urinary calculi, but it is now only one step in total therapeutic or the mentorium for patients with urinary lithiasis.

Urinary lithiasis represents a realm of sharing between the urologist and his medical colleagues. In some instances, medical specialists with training in endocrinologic diseases perform nonsurgical evaluation and treatment of urinary calculus disease. In many instances, however, this is not possible or feasible. Decision about evaluation and treatment of patients with urinary lithiasis often rests with urologist. Urologist

must therefore understand all aspects of etiology, diagnosis and surgical & non surgical treatment of urinary lithiasis.

Ancient man was undeoubtedly afflicted with calculi just as man is now. Riches (1968) refers to a stone that was found in pelvis (Presumably bladder) of an Egyptian mummy estimated to be over 7000 years old. Perhaps because of admonition of Hippocrates, surgical treatment of bladder calculi was for centuries traditionally left to numbers of wandering lithotomists. By the 17th and 18th centuries many of these men had become famous lithotomists of that time.

As Europeans moved to America, they brought with them their predisposition to form bladder calculi. Wangensteen et al (1969) summarized several reviews of lithotomy practice in America during the years. 1810 to 1853, Vogel (1970) noted that in America urinary calculi disease was isolated, predominantly to immigrant Europeans. For instance be reviews the statement that " Savages were unacquainted with a great many diseases that afflict the Europeans, such as gout, dropsy, gravel". Citing another reference, he notes that North carolina Indians were " never troubled by scurvy, dropsy or stone". In 1954, an Inca reporter (cited by vogal) stated that he thought that corn was the factor that prevented occurence

of urinary calculi in native American Indians. Many Indian Herbal treatments were adopted to the treatment of urinary calculus or gravel by the Americans. Thus vogel mentions the use of haw or hawthorn tree, persimmon, sarsaparilla, and decoctions of multiple other leaves and twigs as remedies for stones.

Some authors (notably Prein 1971, and Joly 1931) have used this observed capability of transferrence of European urinary stone disease to the new world to challenge the theory that geographic distribution of urinary calculi has any importance whatsoever.

Whether or not stone disease of early centuries was governed more by heridity or by Environment, there is no doubt that bladder calculi were an endemic part of life prior to the 20th centuary (Ellis, 1969; Ostergoard 1973). Kind (1971) and Prien 1971) noted the historical trend away from bladder calculi towards upper urinary tract calculi whenever a country becomes more indistrialized and diet becomes more nutritious. When agrarian primitive pursuits remain the primary way of life for a population, the incidence of bladder stone disease continues to be high, as it is in Thialand (Lonsdole 1968b; Suvachittanont et al 1973).

By the early 1900's observers of urinary stone disease had already begun to notice an increased occurence of renal and ureteral calculi in Europe, the British Isles and America. This change seemed to paraliel increased industralization.

By 1950, investigators began to report some significant physiologic observations that were associated with production of urinary calculi. These included the importance of diet, especially in association with uric acid bladder calculi (Gutman and Yu 1968). Hypercalciurea was clearly defined as one factor contributing to the formation of calcium calculi (Flocks, 1939), and hypercalciurea due to hyperparathyroidism was identified and separated from idiopathic hypercalciurea (Albright and Reifenstein 1948, Flocks 1940). The importance of nucleatiop of stones in kidney was studied intensively by Randall (1937), who described his famours "Randall Plaues ". Urinary crystals and colloids were discribed, and the crystalloid and colloid composition of all stones was determined (Wesson 1935). The effect of infection on stone formation was noted to be different from the effects of excessive excretion of crystalloids in the absence of infection. Much ground work was laid for the world-wide resurgence of research into the etiology and prophylaxis of urolithiasis that followed world-war II.

The history of stone disease implies that many diverse factors might be involved in its causation: heridity, environment, age, sex, urinary infection, the presence of metebolic diseases and dietory excesses or dificiencies.

Anderson (1973) presents an interesting multifacited theory of epidemology of urinary calculi. He notes that the incidence of upper tract urinary calculi varies greatly with age, anatomic site and geographic distribution and that there are unexplained increases during different periods of history. He feels therefore that there are atleast two separate epidemological factors involved in the genesis of urinary calculi. The first of these may be considered intrinsic. Intrensic factors are related to the inherited biochemical or anatomic makeup of indivisual. For example, African Bantu natives and the related North American Nigros tend to have very few urinary calculi (Modlin, 1967, Pantonowitz et al 1973). A subcategory of this racial or ethnic factor includes any familial tendency to-wards generation of calculi. Familial inheritence of calcium stone disease has been reported by Resnick et al (1968) and McGaown (1960) and reviewed by Finlgson (1974). No true sex-linked inheritence of urinary lithiasis has been defined, but Transhol and Fragdendal (1973) have

reported that male relatives of patients with hypercalciuric stone disease were more often afflicted than female relatives. Intrinsic factors of urolithiasis, then included ethnic, racial or familial background and any inherited physiological or anatomic predisposition to urinary calculi.

Superimposed upon these apparent intrinsic factors are those that Anderson terms extrinsic. Another term for these might be environmental factors. These include climate, water available for drinking dietory patterns or populations and of houshold of people with urinary calculi, the presence or absence of trace elements in food stuffs and drinking water, differing age and sex distributions of types of calculi; and different occupations.

Geography - There is a noticeable increase in urinary calculi in mountainous or tropical areas. Finalyson (1974) reviewed several recent world wide geographic surveys and states that the United States is relatively high in incidence of urinary calculus diseases for its population. Other high incidence areas are Mediterranean countries, northern India & Pakistan, northern Australia central Europe, portions of Malayan peninsula & China.

In summary, geography has some influence on the incidence of urinary calculi and on the types of calculi that occur within a given area. Geography also has an effect in terms of temperature & himidity, which also seemto influence the incidence of human urinary calculi.

Climatic and Seasonal factors - It is difficult to find direct evidence for the influence of climate or the occurence of urinary lithiasis but elevated environmental temperature seem to be definitely related to increased risk of stone disease in populations capable of forming stones.

Water Intake - Two factors involved in the relationship between water intake and urolithiasis are the volume of water ingested as opposed to that lost by perspiration, and the mineral or trace elements content of the water supply of the region. Increased water intake and increased urinary output decreases the incidence of urinary calculi in those patients who are predisposed to the disease. Lonsdale (1968b) pointed out that habitual low levels of water intake may have been related to the high incidence of uric acid stones of British adults in earlier times.

Diet - There can be little doubt that dietary intake of various foods and fluids that result in increased urinary

excretion of substances that produces stones has a significant effect on the incidence of urinary calculi. Ingestion of excessive amounts of purines (Uricacid) (Hodgkinson 1976), oxalate (Thomus 1975), calcium phosphate and other elements often result in excessive excretion of these components in urine.

Occupation - Lonsdale indicated (1968b) that urinary calculi are much more likely to be found in indivisuals who have sedentary occupation, The highest rates of incidence were found in cools and engine room personal and these were probably associated with work conditions that included a hot invironment. Motes (1969) described an interesting method for prevention of stone disease based on his epidemological study " a large consumption of beer & butter is associated with minimal stone disease ".

In summary this review of the epidemology of urinary lithiasis leads us to conclude that the following factors all appear to play some part in the genesis of urinary calculi, heridity, age, sex, geographic location, environmental temperature, water intake, diet & occupation of the indivisual.

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REVIEW OF LITERATURE

REVIEW OF LITERATURE

Urinary lithiasis is one of the most common disease of urinary tract. It occurs more frequently in men than women, a familial predisposition is often encountered.

The history of stone disease implies that many diverse factors might be involved in it's causation: heridity, environment, Age, Sex, Urinary infection, the presence of metabolic disease, and dietary excess or difficiencies to review some of these factors, the epidemeological aspects of urinary calculi are helpful.

EPIDEMEOLOGICAL ASPECTS OF UROLITHIASIS

Anderson (1973) presented an interesting multifacted theory of epidemeology of urinary calculi. He felt that there were at best two separate epidemeological factors involved in the genesis of urinary calculi.

1. Intrinsic factors
2. Extrinsic factors

INTRINSIC FACTORS

1. Heridity - Numerous authors have noted that urinary calculi are relatively rare in the North American Indians the Nigros of Africa and America, and the native born Conversely the incidence of stone disease is known to be highest in some of the colder temperature

areas of the world populated primarily by Eurasians and Caucasions. Various authors conclude that urolithiasis requires a polygenic defect (more than one gene is involved). In adition, genetic predisposition to urinary lithiasis has partial penetrance, so that the severity of stone disease may differ from generation to generation even though individual has the gene defects necessary for urinary lithiasis.

Renal tubular acidosis is one heriditory disease that has been certainly associated with frequent episodes of urolithiasis. Cystinuria is a prime example of familial type of urinary lithiasis that is definitely heriditary. It is a homogenous recessive disease (Grauhall & Watts 1968).

2. AGE AND SEX

The peak age incidence of urinary calculi occurs in the third to fifth decades. About 3 males are afflicted for every female (Borley et al 1974, Burkland Rosenberg 1955, Fetter and Zinskind 1961, Frank et al, 1959). These authors have pointed out that the maximum incidence of urinary lithiasis appears to occur in the 30 to 50 years age group.

Lonsdale (1968b) observed that incidence of upper urinary tract calcification is aproximately equal in male and female at the time of autopsy.

Several authors have commented upon the apparently equal tendency towards urinary lithiasis in males and females during childhood (Madek and Kelalis, 1975; Prina and Scardino, 1960). This observation coupled with reports that increased serum testosterone levels resulted in increased endogenous oxalate production by liver (Liao and Richardson, 1973), led Finlayson to postulate that lower serum testestrone level may contibute to some of the protection that women (and children) enjoy against exalate stone disease. Recently, Welshman and McGeown (1973) have demonstrated increased urinary citrate concentration in urine of females, and they postulate that this may aid in protecting females from calcium urolithiasis.

EXTRINSIC FACTORS

1. Geography - There is noticeable increase in urinary calculi in mountainous or tropical areas. Boyce et al (1956) performed in extensive study of incidence of calculus disease in the United States. Finlayson (1974) reviewed several recent world wide geographic surveys and stated that the United States is relatively high in the incidence of urinary calculus disease for it's population. Other high incidence areas are the British isles, Scandinavia, Mediaterranean countries, Northern India and pohiston,northern Fusbolia, central Europe, Portions of the Malayan Ferinsula, and China.

In addition to different incidences for all urinary calculi combined, there are differences in types of urinary stone disease in different areas of world. Lonsdale (1968a and b) and Suter and Wooley (1970, 1971, 1974) have reported extensive geographic surveys of types of urinary calculi. They have noted for example that stones from Great Britain, Scotland and Sudan are similar and are composed primarily of mixed calcium oxalate and calcium phosphate. In other areas of world most upper urinary tract calculi are composed mainly of magnisium, Ammonium phosphate (Struvite).

A number of children's stones from under developed areas such as Thailand were analysed by Sater et al (1974b). They stated that approximately 89 percent of these stones contained Ammonium acid urate or calcium oxalate or both. Examination of nuclei of these calculi suggested that ammonium urate was the primary component. Hazarika et al (1974) reported that upper urinary tract calculi analysed in India contained mostly calcium oxalate or calcium phosphate. Uric acid or ammonium urate calculi were rarely encountered.

2. Climatic and Seasonal Factors

It is dificult to find direct evidence for the influence of climate on occurence of urinary lithiasis. Several authors, however have attempted to show a relationship between higher environmental temperature and increased seasonal incidence of urinary stone disease. For example

Prince et al (1956) related their observations on seasonal variation in the incidence of urinary calculi to higher summer temperature in the South-Eastern United States.

Prince and Scardino (1960) - followed this study with a prospective analysis of 922 occurences of ureteral stone. Once again the peak incidence occured in July, August and September. On examining their later reports, one notes that the highest incidence of urinary calculi appears to occur 1 to 2 month following the achievement of the maximum mean annual temperature in their area.

Rivera (1973) - studied the seasonal incidence of urinary calculi in the area surrounding Sanjuan, Puerto Rico. Maximum incidence of urolithiasis in this northern hemisphere region occured in Jyly through October in most years. Highest average monthly temperature in the area occured in the months of August and September. During the study some unusual coolness occured during periods when relatively high temperature would be expected. There was a decrease in the number of calculi during these unexpected cool periods. Rivero concluded that urinary calculi follow a recurrent annual cycle with increased occurence during the hot months. In contrast Elliott (1975) concluded form a 10 years study of seasonal variations in urolithiasis that peak stone incidence

occured during periods of above average temperature and below average rainfall. In view of conflicting data accumulated from dry regions, it appears that man temperature remains the most crital factor.

Elevated environmental temperature seems to be definitely related to increased risko of stone disease in population capable of forming stones. High temperature increases perspiration which may result in increased concentration of urine. This hyper concentration could contribute to stone formation in many ways. For example, if the individual has, as noted above, an in born tendency towards formation of calculi, dehydration would result in decreased urine volume and increased urinary concentration of these molecules as well as excessive urinary acidity (Tool et al 1964). These two charges promote crystalization of the respective molecules. In persons with a tendency to form calcium calculi, urinary concentration of calcium oxalate and phosphate would increase large crystals could form, possibly aggregatting into stones. Patient with a tendency towards formation of uric acid or cystine calculi would have an additional risk because acid urine holds machless uric acid and/or cystine in solution. One admonition to stone formers as derived from these studies, then, might be to "Keep Cool".

3. Water Intake and Urinary Lithiasis

Two factors involved in the relationship between water intake and urolithiasis are the volume of water injested as opposed to that lost by perspiration, and the mineral or trace element content of water supply of the region. One of the prevailing assumptions in the literature of urolithiasis is that increased water intake and increased urinary output decreases the incidence of urinary calculi in those patients who are predisposed to the disease. Finlayson (1974) demonstrated that increased urine flow causes a reduction in urine oxalate (concentration. However to be significantly effective a urine output of more than 3600 ml per day would be theortically necessary. Blacklock (1969) reported that by increasing urinary output from approximately 800 to 1200 ml per day, incidence of urinary calculi in sailors decreases by 86 percent. Other investigators have suggested that the mineral content of water may contribute to causation of stone disease. Data are conflicting, however. Some say that excessive water hardness (Usually calcium sulphate) contributes to calculi (Rose and Westbury, 1975), while others say that excessive softness (as when sodium carbonate is predominent) causes increased incidence of stone disease (Evens et al, in press). Additionally, the presence or absence of certain trace elements in water has been implicated in the formation of urinary calculi. For

example, Zinck is an inhibitor of calcium crystalization (Elliot and Eusebia 1967) and low urinary levels of zinc could therefore increase tendency toward stone formation.

4. Diet

There can be little doubt that dietary intake of various foods and fluids that result in increased urinary excretion of substances that produce stone has a significant effect on the incidence of urinary calculi. Peculiar dietary excesses may also occur. Such as use of large amount of worcestershire sauce with its high oxlate content, vegetarian diet, or habitual excessive ingestion of milk products in the form of ice cream.

5. Occupation

Lonsdale indicated (1968b) that urinary calculi are much more likely to be found in indivisuals who have sedentary occupations. Flacklock (1969) reported that the incidence of urinary calculi was higher in administrative and sedentary personal of Royal Navy than in manual workers. Anderson(1973) emphasized that the relationship between diet and heridity is the major determinent for urolithiasis, but that occupation is also important. Occupation also tends to determine exposure to other factors such as high environmental temperature that may then increase tendency towards formation of urinary calculi.

PRESENT THEORETICAL BASIS OF ETIOLOGY OF URINARY LITHIASIS

Modern concepts of urina ry calculus disease may be separated conveniently into fine major theories.

1. Supersaturation/crystalization theory
2. The matrix nacleation theory
3. The hinhibitor absence theory
4. Dpitaxy
5. Combinations of above

Supersaturation/crystalization - Uric acid and cystine calculi for whenever urine with a tendency to remain at an acid pH becomes over saturated with uric acid or cystine. Magnesium ammonium phosphate (struvite) calculi form whenever the product of concentration of these ions exceed the saturation product and when the urine remains alkaline for long periods of time.

Inhibitor Lack

Robertson and colleagues (1976) have produced such a theory for calcium oxalate urina-ry lithiasis. Their studies suggest that for calcium oxalate calculi an index of supersaturation versus inhibitor can be determined for an indivisual, and that stone formers show greater supersaturation and less inhibition of crystalization and stone formation.

Matrix initiation

Matrix is a derivative of several of mucoproteins of urine. Matrix content of a given stone varies, but most solid urinary calculi have a matrix content of about 3 percent by weight (Boyce and King 1959).

Matrix may inhibit crystal growth, interfere with cyystal aggregation, and even enhance stone growth. At the present time the uramucoid of normal individuals is thought to be a beneficial inhibitor of crystalization and stone formation, whereas the matrix of stone formers represents uromucoid with some qualitative defect that alters it's ability to inhibit crystalization or even causes it to promote stone formation (Finlayson 1974).

Intranephronic and Fixed nucleation - These workers state that the major process that ultimately leads to stone formation is aggregation of small crystals formed previously in the kidney. Some investigators believe that the initial nucleation and growth of nuclei and crystals begin in the renal tissue (intranephronic),while others believe that the process begins freely is renal tubular urine. Intranephroc calculosis is probably most important in calcium stone disease.

Extranephronic and free Particle nucleation

Proponents of extranephronic theory of urinary stone formation believe that it all happens in urine.Hence one possibility of matrix theory of stone formation is the fact that uromucoid normally acts as an inhibitor. Patients with stone disease may lack some significant component of uromucoid or produce additional components that decrease its inhibiting action.

Epitaxy

If a crystal has a pattern or organization of ions that is regular and predictable, this structure is called a lattice. This surface latice may resemble very closely that of second best different type of crystal. Depending upon closeness of resemblance, the second type of crystal may actually be able to grow upon the surface of the first. Epitaxy requires oriented overgrowth of one crystal on the surface of the another.

Final Theory

This final theory of urolithiasis is an attempt to comprise all the elements discussed previously.

1. Renal function must be adequate for the excretion of excess amount of crystallizable substances.
2. Kidney must be able to adjust it's pH excretion to confirm to that required to crystallise the substance.
3. Urine must have a complete or relative absence of a number of inhibitors of crystalization of the crystalizable components.
4. Crystal mass must reside in the urinary system for a time sufficient to allow growth or aggregation of crystal mass to a size large enough to obstruct the urinary passage through which it is proceeding. Hence stasis may have an important part in the genesis of urinary calculi.

MATERIAL AND METHODS

MATERIAL AND METHODS

1. A combined retrospective study from August 1984 to July 1989 and prospective study from August 1989 to July, 1990, of urinary stone cases admitted at M.L.B.Medical College, Hospital, Jhansi has been done -

The objects of this study were -

I. To see whether there is higher incidence of urinary stones in any particular season or month.

II. To compare the incidence of renal, ureteral, vesical and urethral stones in various periods of climate and season.

III. To assess the causes of high incidence of urinary stones.

2. The metereological data on temperature, relative humidity, and rainfall for the period of 1969-80 of Jhansi District were obtained from Regional Metereological centre, New Delhi, and for period of 1989-90 were obtained from Metereological Department Jhansi.

3. The cases of urinary stone were classified as follows -

I. Renal calculus

II. Ureteric calculus

III. Vesical calculus

IV. Urethral calculus

4. The climatic and seasonal variation of incidence of urinary stones in Bundelkhand region was seen as monthly

total and average urinary stone positive cases admitted in this hospital during 1984-90.

5. Comparision of the incidence of Renal, Ureteric, vesical and urethral stones in various period of climates and season has been done.

6. The percentage of high serum calcium levels in known cases of urinary stones was taken in the prospective study.

7. Presence of exalate and phosphate crystals in the urine of patients with urinary stones was correlated with the causes of stone formation.

8. Study of sex distribution in urinary calculus positive cases was done.

9. Study of Age distribution of renal, ureteric, vesical and urethral & total stone cases was done.

The age group were classified as follows -

i. Paediatric Age group — Upto 12 years.

ii. Adult age — 12 -14 years.

iii. Old age — More than 40 years.

10. Following investigations have been done for urinary stone cases in the prospective study.

i. Haemogram

ii. Urine for Albumin, Sugar, and Microscopic examination.

iii. Blood urea

iv. Blood sugar

v. X-ray KUB region and I.V.P.

vi. Urine cultures and their senstivity to antibiotics.

vii. Serum calcium levels.

11. Compilation and analysis of obtained data has been done and compared with global statistics.

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OBSERVATIONS

OBSERVATIONS

Bundelkhand region comprises five districts of Uttar Pradesh and six districts of Madhya Pradesh. We have done a study of urinary stone positive cases in the Bundelkhand region assessing the fact that cases of urinary stones comming at the Medical College, Jhansi are reflective of situation prevailing in the whole Bundelkhand region because this is the only medical educational institution of Bundelkhand.

1. Average Metereological conditions of temperature, relative humidity and Rainfall.

Table 1 gives the 5 year means of monthly maximum and minimum temperature, relative humidity and rainfall in Jhansi district.

Date in Table 1 revealed.

1. Mean monthly maximum temeperature ranging from 24.1°C in the month of January to 42.6°C in the month of May.
2. Mean monthly minimum temperature ranging from 9.2°C in the month of January to 29.3°C in the month of June.
3. Mean monthly relative humidity at 8.30 hours ranging from 26% in the month of May to 84% in the month of August.
4. Mean monthly relative humidity at 17.30 hours ranging from 15% in the month of May to 76% in the month of August.

5. Mean monthly rainfall ranging from 2.7 mm in the month of April to 309.1 mm in the month of August.

Table 2 - gives the means of monthly maximum, minimum temperature and relative humidity in Jhansi district during the period of prospective study of 1989-90.

Data in table 2 revealed.

1. Mean monthly maximum temperature ranging from 25.2°C in the month of December to 42.8°C in the month of May and June.
2. Mean monthly minimum temperature ranging from 7.3°C in the month of January to 29.5°C in the month of June.

2. Monthly total and average urinary stone positive cases

Table 3 - gives the monthly total and average urinary stone positive cases during 1984 to 1990.

Data in table 3 revealed that

1. A total of 1118 cases of urinary stones were admitted in this hospital during the period of 1984-90.
2. The maximum number of positive cases were admitted in the month of July (150 cases) followed by month of August (122) and June (118) with the average of 25.0, 20.3 and 19.7 per month respectively.
3. The minimum number of positive cases were admitted in the month of December (49 cases) followed by November (65) and February (80 cases) with the average of 8.1, 10.8, 13.3 cases per month respectively.

3. Monthly total and average renal stone positive cases

Table 4 - gives the monthly total and average Renal stone positive cases during 1984 to 1990.

Data in Table 4 revealed that

1. A total of 399 cases of Renal stone were admitted in this hospital.
2. The maximum number of positive cases were admitted in the month of July (62 cases) followed by June (41 cases) with the average of 10.3 and 6.8 cases per month respectively.
3. The minimum number of positive cases were admitted in the month of December.
4. There is no definite trend of monthly increase of decline in Renal stone cases.

4. Monthly total and average ureteric stone cases

Table 5 - gives the monthly total and average ureteric stone cases admitted during the period of 1984-1990.

Data in table 5 revealed that

1. A total of 207 cases of ureteric stone were admitted in this hospital.
2. The maximum number of cases were admitted in the month of June (25 cases) and October (25 cases) with the average of 5 cases per month each.
3. The minimum number of cases were admitted in the month of December (10 cases) and February (11 cases) with the average of 20 and 2.2 cases per month respectively.

5. Monthly total and average vesical stone cases

Table 6-gives the monthly total and average vesical stone cases admitted in this hospital from August 1984 to July 1990.

Data revealed that

1. A total of 482 cases of vesical stone were admitted in this hospital.
2. The maximum number of cases were admitted in the month of July (63 cases) and August (62 cases) with the average of 10.8 and 10.3 cases per month respectively.
3. The minimum number of cases were admitted in the month of December (23 cases) and November (26 cases) with the average of 3.8 and 4.3 cases per month.

6. Monthly total and average urethral stone cases

Table 7 - gives monthly total and average urethral stone positive cases from August 1984 to July 1990.

Data revealed that

1. A total of 30 cases were admitted in the hospital.
2. The number of admissions were so small in amount that we can not take monthly average.

7. Serum calcium levels

Table 8 - gives the increased serum calcium levels in the various urinary stone cases admitted in this hospital during the period of August 1989 to July 1990. Serum calcium more than 10.5 mg% was taken as increased levels.

Data revealed that

1. Serum calcium was increased in 9.3 percent cases of renal stones, 3.1 percent cases of ureteric stones,
   i. 03 percent cases of vesical stones.
   ii. Serum calcium was increased in 5.3 percent cases of total urinary stones admitted in this hospital.

10. Urinary oxalate and phosphate crystals

Table 9 - gives positive cases of oxalate and phosphate crystals in the microscopic examination of urine in the hospital admitted cases during the period of August 1989 to July 1990.

Data revealed that

1. Oxalate crystals were found in the urine of 15.6% cases of renal stones, 9.7% cases of ureteric stones, 2% cases of vesical stones with the average of 7.6% cases in total urinary stones.
2. Phosphate crystals were found in the urine of 3.1% cases of renal stones, 2.3% cases of ureteric stones, 3.1 percent cases of vesical stones and not found in urethral stones, with the average of 3.3% cases in total urinary stones.

11. Sex Distribution

Table 10 - gives sex distribution of urinary stone cases admitted in this hospital during 1984-1990.

Data revealed that

1. A total of 943 male and 175 female cases were admitted which gives male female ratio of 5.4:1.

2. 315 male and 84 female case of renal stone were admitted with the ratio of 3.8:1.
3. 179 male and 38 female cases of ureteric stone were admitted with M/F ratio of 4.4:1.
4. 431 male and 51 female cases of vesical stones were admitted with the male/female ratio of 8.5:1.
5. 28 male and 2 female cases of urethral stones were admitted with the male/female ratio of 14:1.

12. Age Distribution

Table 15 - gives age distribution in total urinary stone cases admitted in this hospital during 1984 to 1990.

The age group were classified as follows -

I. Paediatric age — Less than 12 years age.

II. Adult age group — 12 years to 40 years.

III. Old age group more than 40 years.

Data in table 15 revealed that

1. A total of 284 cases in Paediatric age group, 589 cases of adult age and 245 cases of old age group were admitted with the percentage of 25.4, 52.6 and 21.9% respectively.

13. Age distribution in renal stone cases

Table 11 - shows age distribution in renal stone cases admitted in this hospital during 1984 to 1990.

Data in table 11 shows

1. A total of 399 cases of renal stones were admitted 32 of which were paediatric age group, 275 of adult group and 92 of old age.

2. The percentage of paediatric age, adult age and old age were 8.0%, 69% and 23% respectively.

14. Age distribution in ureteric stone cases

Table 12 gives age distribution in ureteric stone cases admitted in this hospital during 1984-1990.

Data in table 12 shows

1. A total of 207 cases of ureteric stone were admitted in this hospital, 19 of which were paediatric age, 153 of adult age and 35 of old age group.

15. Age distribution in vesical stone cases

Table 13 - shows age distribution in vesical stone positive cases admitted in this hospital during the period of 1984 to 1990.

Data revealed that

1. A total of 482 cases of vesical stones were admitted, 216 of which were paediatric, 151 adult and 115 old age group.
2. The percentage were 44.8%, 31.3% and 23.8% of paediatric, adult and old age group respectively.

16. Age distribution in urethral stone cases

Table 14 - shows age distribution in urethral stone cases admitted in this hospital during the period of 1984 to 1990.

Data shows -

1. A total of 30 cases of urethral stone were admitted, out of which 17 cases were paediatric, 10 adult and 3 of old age group.

2. The percentage were 56.1%, 33.3% and 9.9% of paediatric adult and old age group respectively.

Table No. 1

Showing mean monthly maximum and minimum temperature relative humidity and Rainfall in Jhansi District during 1969-80.

Month	Maximum temperature °C	Minimum temperature °C	Mean humidity %		Mean R/F (mm)
			8.30 hours	17.30 hours	
January	24.1	9.2	66	39	17.2
February	27.5	11.7	56	28	14.0
March	33.5	17.4	37	18	11.0
April	38.9	23.3	26	16	2.7
May	42.6	28.8	26	15	8.4
June	40.4	29.3	48	37	105.4
July	33.5	25.9	78	70	297.9
August	31.7	24.9	84	76	309.1
September	32.5	24.1	78	65	190.4
October	33.3	19.5	60	40	32.0
November	29.7	13.1	51	32	5.3
December	25.5	9.3	61	39	6.7

Table No. 2

Showing mean monthly maximum and minimum temperature and humidity in Jhansi District during 1989-90.

Month	Maximum temperature °C	Minimum temperature °C	Mean humidity 8.30 hours	Mean humidity 17.30 hours
August 89	35.9	24.6	73	85
September 89	34.9	23.8	74	65
October 89	35.2	22.1	46	30
November 89	32.2	13.2	53	42
December 89	25.2	11.4	72	56
January 90	25.7	7.3	45	42
February 90	27.1	12.8	58	40
March 90	35.3	14.2	47	44
April 90	38.4	22.2	40	13
May 90	42.8	28.6	52	27
June 90	42.8	29.5	46	36
July 90	33.2	25.0	70	81

Table No. 3

Monthly total and average urinary stone positive cases during 1984-1990.

Month	Positive cases								
	1984	85	86	87	88	89	90	Total	Avera-rage
January	Na*	11	27	6	17	15	18	94	15.7
February	"	10	9	11	26	11	13	80	13.3
March	"	8	17	14	23	7	15	84	14.0
April	"	8	9	12	26	16	16	87	14.5
May	"	13	7	8	20	16	17	81	13.5
June	"	17	15	17	31	16	22	118	19.7
July	"	20	28	24	21	29	28	150	25.0
August	18	14	21	20	21	28	Na*	122	20.3
September	12	11	18	9	27	19	"	96	16.0
October	15	16	18	11	20	12	"	92	15.3
November	8	10	4	18	10	15	"	65	10.8
December	6	8	6	11	12	6	"	49	8.1
Total	59	146	179	161	254	190	129	1118	

* Na - not available

Table No. 4

Monthly total and average Renal stones positive case during 1984-1990

Month	Positive cases								
	1984	85	86	87	88	89	90	Total	Average
January	Na*	8	9	4	7	3	7	38	6.3
February	-	3	2	3	11	2	5	26	4.3
March	"	4	5	9	8	5	3	34	5.6
April	"	5	3	8	4	5	6	31	5.2
May	"	3	5	2	6	2	7	25	4.2
June	"	9	5	8	6	4	9	41	6.8
July	"	10	13	6	10	15	8	62	10.3
August	7	9	8	2	4	5	Na*	35	5.8
September	2	7	6	3	8	5	"	33	5.5
October	4	8	5	5	6	3	"	31	5.2
November	5	9	2	3	6	3	"	28	4.7
December	3	5	1	0	3	3	"	15	2.5
Total	21	80	64	55	79	55	45	399	

Na* - Not available

Table No. 5

Monthly total and average ureteric stone positive case during 1984-1990.

Month	Positive cases								
	1984	85	86	87	88	89	90	Total	Average
January	Na*	Na*	6	Nil	1	3	3	13	2.6
February	"	"	2	3	3	3	0	11	2.2
March	"	"	2	2	6	1	5	16	3.2
April	"	1	2	1	8	7	2	21	3.8
May	"	-	1	-	3	2	6	12	2.4
June	"	-	4	4	8	6	3	25	5.0
July	"	-	5	3	2	5	4	19	3.8
August	"	-	5	6	7	4	Na*	22	4.4
September	"	1	3	4	10	4	"	22	4.2
October	"	-	8	2	9	6	"	25	5.0
November	"	-	1	4	2	4	"	11	2.2
December	"	-	2	3	5	0	-	10	2.0
Total		2	41	32	64	45	23	207	

Na* - Not available

Table No. 6

Monthly total and average vesical stone positive cases during 1984-1990.

Month	Positive cases								
	1984	85	86	87	88	89	90	Total	Average
January	Na*	3	9	2	9	8	6	37	6.2
February	"	6	5	6	12	6	7	42	6.3
March	"	3	9	3	9	1	7	32	5.3
April	-	2	4	3	14	4	7	34	5.6
May	"	9	0	5	10	11	4	39	6.0
June	"	8	6	4	15	5	10	48	8.2
July	"	10	9	15	7	10	14	65	10.8
August	10	5	8	12	9	18	Na*	62	10.3
September	8	3	9	0	9	10	"	39	6.5
October	13	6	5	4	4	3	"	35	5.8
November	3	1	1	12	2	7	"	26	4.3
December	3	2	3	8	4	3	"	23	3.8
Total	37	58	68	74	104	86	55	482	

Na* - Not available

Table No. 7

Monthly total and average urethral stone positive cases during 1984-1990.

Month	Positive cases								
	1984	85	86	87	88	89	90	Total	Average
January	-	-	3	-	-	1	2	6	
February	-	1	-	-	-	-	1	2	
March	-	-	1	-	-	-	-	1	
April	-	-	-	-	-	-	1	1	
May	-	1	1	1	-	1	-	4	
June	-	-	-	1	2	-	-	3	
July	-	-	1	-	2	-	2	5	
August	-	-	-	1	1	1	-	3	
September	-	-	-	-	-	-	-	0	
October	-	2	-	-	1	-	-	3	
November	-	-	-	-	-	2	-	2	
December	-	-	-	-	-	-	-	0	
Total		4	6	3	6	5	6	30	

Table No. 8

Percentage of increased serum calcium levels in urinary stone positive cases during 1989-90.

	Total cases	Increased Serum Calcium level cases	% of cases increased Serum Calcium
1. Renal stone	64	6	9.3
2. Ureteric stones	41	3	3.1
3. Vesical stones	96	2	1.03
4. Urethral stones	7	0	0
Total	208	11	5.3

Normal serum calcium = 8.3 - 10.5 mg%

Table No. 9

Urine oxalate and phosphate crystals positive cases of urinary stones during 1989-90.

Cases	Total	Oxalate crystals positive cases	Phosphate crystals positive cases	% oxalate crystals positive cases	% phosphate crystals positive cases
1. Renal stone	64	10	3	15.6	3.1
2. Ureteric stone	41	4	1	9.7	2.3
3. Vesical stone	96	2	3	2.0	3.1
4. Urethral stones	7	0	0	0	0
Total	208	16	7	7.6	3.3

Table No. 10

Sex distribution in urinary stone positive cases during 1984 - 90.

Cases	1984		1985		1986		1987		1988		1989		1990		Total		Ratio	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1.Renal stone	20	1	64	16	52	12	44	11	65	14	37	18	33	12	315	84	3.75	1
2.Ureteric stone	-	-	2	0	32	9	24	8	50	14	40	5	21	2	159	38	4.4	1
3.Vesical stone	34	3	53	5	62	6	69	5	93	11	72	14	48	7	431	51	8.5	1
4.Urethral stone	-	-	4	0	5	1	3	0	6	0	4	1	6	0	28	2	14	1
Total	54	4	123	21	151	28	140	24	214	39	153	38	108	21	943	175	5.4	1

M = male

F = female

Table No. 11

Age distribution in Renal stone positive cases during 1984 - 1990.

Age group	Positive cases								
	1984	1985	1986	1987	1988	1989	1990	Total	Average %
1. Paediatric (< 12 yrs)	2	7	2	3	9	6	3	32	8.0
2. Adult (12–40 yrs)	9	48	46	39	63	37	33	275	69
3. Old age (> 40yrs)	10	25	16	13	7	12	9	92	23
Total	21	80	64	55	79	55	45	399	100

Table No. 12

Age distribution in ureteric stone positive cases during 1984 - 1990.

Age group	Positive cases								
	1984	1985	1986	1987	1988	1989	1990	Total	Average %
1. Paediatric (< 12 yrs)	-	-	2	7	5	3	2	19	9.2
2. Adult (12 - 40 yrs.)	-	-	32	20	44	39	18	153	73.9
3. Old age (> 40 yrs)	-	2	7	5	15	3	3	35	16.9
Total	-	2	41	32	64	45	23	207	100.0

Table No. 13

Age distribution in vesical stone positive cases during 1984 - 1990.

Age group	Positive cases								
	1984	1985	1986	1987	1988	1989	1990	Total	Average %
1.Paediatric (< 12 yrs)	19	26	35	33	43	37	23	216	44.8
2.Adult (12-40yrs.)	8	23	23	14	38	26	19	151	31.3
3.Old age (> 40 yrs.)	10	9	10	27	23	23	13	115	23.8
Total	37	58	68	74	104	86	55	482	100

Table No. 14

Age distribution in Urethral stone positive cases during 1984 - 1990.

Age group	Positive cases								
	1984	1985	1986	1987	1988	1989	1990	Total	Average %
1.Paediatric (⩽ 12 yrs.)	-	4	4	-	4	1	4	17	56.1
2.Adult (12-40yrs.)	-	0	2	1	1	4	2	10	33.3
3.Old age (⩾ 40 yrs.)	-	0	-	2	1	0	0	3	9.9
Total	-	4	6	3	6	5	6	30	100

Table No. 15

age distribution in total urinary stone positive cases during 1984 - 1990.

Age group	Positive cases					
	Renal stone	Ureteric stone	Vesical stone	Urethral stone	Total	%
1.Paediatric Age	32	19	216	17	284	25.4
2.Adult	275	153	151	10	589	52.6
3.Old age	92	35	115	3	245	21.9
Total	399	207	482	30	1118	100

DISCUSSION

D I S C U S S I O N

The study of effect of climate and season of Bundelkhand region on urinary stones is important in the epidemeology of urolithiasis and evolving strategy for it's control.

Jhansi distrect has hot and dry climate as revealed by matereological data. Maximum monthly temperature occurs in the month of April, May and June where as maximum monthly stone cases occured in the month of June July and August. It shows that either maximum stone formation follows the maximum temperature period or the cases came to us shall have initiation of stone formation during this hot season. This data reveals that the high incidence of urinary calculi appears to occur 2 months following the achievement of the maximum mean annual temperature in this area. This study is similar to study of Prince and Scardino (1960) who noted that the highest incidence of prinary calculi appears to occur 1 to 2 months following the achievement of maximum mean anual temperature in their area.

Bateson (1973) concluded that peak incidence of urinary calculi coincides with the peak maximum

summer temperature. Rivera (1973) concluded that urinary calculi follow a recurrent anual cycle with increased occurance during the hot months. Peak incidence immediately followed periods of higher temperature of increased humidity.

Minimum monthly temperature occurs in the month of December, January and February whereas minimum urinary stone cases occured in the month of November, December and February. In the month of January a comparative higher incidence of stone disease was found than February. This shows that minimum monthly urolithiasis coincides with minimum monthly temperature with the exception of January which is the coolest month in Jhansi out the number of cases in this month were more in number than cases in December or February. The data reveals that the lowest incidence of urolithiasis appears to occur simultaneously with the minimum mean annual temperature in this area.

The highest humidity occurs in the month of July, August and September, which coincides with the high incidence of urolithiasis and lowest humidity which occurs in the month of February, March and April with nearly equal incidence of urolithiasis in each month. These data reveal that there should be some relationship

with humidity also as higher the humidity, more the occurence of stone disease. We can not say the relative importance of temperature and humidity as without taking one of them constant one can not say about their relative importance, which is not possible for this region. These data coincides with the study of Rivero (1973) who stated that peak incidence immediately followed periods of high temperature, increased humidity, increased perspiration and slower winds, but Prince et al (1956) stated that the relative humidity in their area (South eastern united states) ranged between 70 and 80 percent throughout the year and therefore did not appear to be related to peak incidence of urinary stone disease. In view of these conflicting data it appears that temperature remains the most critical factor.

The mean monthly reinfall in Jhansi district is highest in the month of June, July and August, which exactly coincides with the high incidence of urolithiasis. This is in contrast of Elliott (1975) study who concluded that peak stone incidence occured during periods of above average temperature and below average reinfall.

A total of 399 cases of Renal stone were admitted in our study which is followed by incidence of vesical stones. Maximum monthly renal stone cases occu-

red in the month of June, July and August, whereas maximum monthly temperature occurs in the month of April May and June. It shows that maximum renal stone occurence follows the maximum temperature period by two months. There is again a rise in the occurence of renal stone cases in the month of January which is the month of lowest temperature in this area. How this minimum temperature explains the moderately high occurence of renal stones, can not be explained on this basis but the higher incidence of total urinary stone cases in the month of January should be because of this higher. incidence of renal stones.

Minimum renal stone cases occured in the month of December, February, May and November whereas minimum monthly temperature occurs in the month of December, January and February. This shows that there is no definite relationship with the occurence of renal stone disease and lower atomospheric temperature in this region. The highest humidity occurs in the month of July, August and September which coincides with the high incidence of renal stone disease. These data on relative humidity reveal that there should be some relationship with humidity also as higher the humidity, more the occurence of renal stone disease.

The mean monthly rainfall in this region is highest in the month of June, Jyly and August which exactly coincides with the high incidence of renals stone disease.

A total of 207 cases of ureteric stones were admitted in our study period which shows a fairly high incidence.

The maximum monthly ureteric stone cases came to o/s in the month of June, through October, where as maximum monthly temperature occurs in the month of April May and June. It shows that the highest, ureteric stone formation follows the maximum mean annual temperature by two to four months. This study is similar to study of Prince and Scardino (1960) on ureteric stones, who noted that highest incidence of ureteric calculi appears to occur 1 to 2 months following the achievement of maximum mean annual temperature in their area.

The minimum number of ureteric stone cases occured in the month of December, January and February which coincides with the minimum monthly temperature. So it appears that lowest incidence of ureteric stone disease occurs simultaneously with the minimum mean annual temperature in this region.

The highest humidity occurs in the month of July, August and September which coincides with the high incidence of ureteric stone and lowest humidity which does not coincides with the lowest incidence of ureteric stones (December, January and February). The data reveal that

humidity does not has much significance on occurence of ureteric stones. Prince et al (1956) also stated that the relative humidity in their area (South Eastern United States) ranged between 70 to 80 percent throughout the year and therefore did not appear to be related to peak incidence of ureteric stone disease.

The mean monthly rainfall in Jhansi district is highest in the month of June, July, August & September which exactly coincides with highest incidence of ureteric stone disease.

A total of 480 cases of vesical stones were admitted in this hospital in our study period which shows the highest incidence according to site. The maximum monthly vesical stone cases came to us in the month of June, Jyly and August where as maximum monthly temperature occurs in the month of April, May and June. It shows that the highest vesical stone formation follows the maximum mean annual temperature by two months. The minimum number of vesical stone cases came to us in the month of November and December, which coincides with the minimum monthly temperature. So it appears that the lowest incidence of vesical stone disease occurs simultaneously with the minimum mean annual temperature in this region. The highest humidity occurs in the month of Jyly,August and September but there is a acute fall of vesical stone

cases in the month of September, and lowest humidity which occurs in the month of February, March and April which does not coincide with the lowest incidence of vesical stone cases.

The data reveals that humidity does not has much significance on occurence of vesical stones. The mean monthly rainfall in Jhansi district is higher in the month of June, July and August which exactly coincides with highest incidence of vesical stone.

A total of 30 cases of urethral stone were admitted in our study period which shows a very low incidence. The number of urethral stone cases are so small that it can not be corelated with the monthly environmental temperature, humidity or rainfall.

The serum calcium was increased in 5.3% cases admitted in this hospital during our prospective study period. Hypercalcemia may be produced by a number of clinical conditions like -

1. Hyperparathyroidism
2. Vit. D intoxication
3. Idiopathic infantile hypercalcemia
4. Sarcoidosis
5. Multiple myeloma
6. Hyperparathyroidism
7. Metastatic malignant neoplasm
8. Leukaemia

9. Lymphoma
10. Milk alkali syndrome
11. Myxedema
12. Adrenal insufficiency

The problem of recurrent or bilateral urinary stones was investigated for hypercalcimia and hypercalciures.

Southerland reported an increased urinary excretion of calcium in nearly 60% of his series of patients with renal calculi. Boyce et al (1959) stated that 80% of patients with calculus disease requiring hospitalization had urinary calcium excretion rates in the so called normal range (50 - 300)mg per 24 hours) and each had only one or two calculi. The remaining 20% had recurrent or bilateral stones, and 80% of this group had hypercalciures. The presence or absence of calculi does not depend solely on the presence of hypercalciures, since many patients with no history of calculi excrete large amount of urinary calcium without forming calculi. With the exceptions of primary parathyroidism and certain malignant tumours that secrete excessive amounts of parathyroid hormone, most causes of hypercalcimia can be readily recognised from a carefully elicited history, a physical examination and appropriate radiological and

laboratory studies.

Oxalate crystals were found in the urine of 7.6% cases of urinary lithiasis and highest number of cases were of renal stones. As oxalate is a major factor in the formation of calcium oxalate stones so it's presence in the urine of a patient can be correlated with causation of stone formation and may be helpful in the treatment like dietary control of oxalate rich food stuff, especially in the cases of multiple and recurrent stone disease problem.

Phosphate crystals were found in the urine of 3.3% cases of urinary lithiasis. It's presence in the urine of a known urinary stone patient can be correlated to the phosphate calculi causation and can be helpful in the treatment of phsphatic calculi eg. Aluminium gel 40 ml tds do and at bed time drastically reduced the incidence of recurrence; excessive alkalinity of urine should be treated by giving ammonium chloride.

A total of 943 male and 175 female cases of urinary lithiasis were admitted in this hospital during our study period which gives male, female ratio of 5.4:1. The sex ratio is comparatively higher than the studies of Barley et al 1974, Burkland and Rosenberg 1955, Fetter and Zinskind 1961, Frank et al 1959. About three males were affected for every female in their study. With repo-

rts that increased serum testosterone levels resulted in increased endogenous oxalate production by liver (Liao and Richardon 1972), led Finlayson to postulate that lower serum testosterone may contribute some of the protection that women and children enjoy against oxalate stone disease. Recently Wilsman and McGeown(1975) have demonstrated increased urinary citrate concentration in urine of females and they postulate that this may aid in protecting female from calcium urolithiasis. We find lesser difference in the male/female cases of urolithiasis in upper urinary tract like renal and ureteric stone cases in comparision to lower urinary tract like vesical & urethral calculi, where urinary lithiasis is the problem of mainly males. Lonsdale (1968b) observed that incidence of upper urinary tract calcification is aproximately equal in males and females at the time of autopsy.

Age distribution in urolithiasis shows that 25.4% were of paediatric age group, 52.6% of adult group and 21.9% of old age group. So the peak incidence of urinary calculi occurs in the adult age group (12-40 yrs.) that is from second to fourth decade of life. So the age incidence is comparatively earlier in our study than the study of Fetter and Zimskind (1961) Frank et al (1959), who pointed out that the maximum incidence of urinary lithiasis appears to occur in the 30 to 50 yrs. age group.

Age incidence in renal stone cases shows that the percent age of paediatric age, adult age and old age were 8.0%, 69% and 23% respectively. So it is mainly adult age group (12 - 40 yrs.) who are involved in renal stone disease.

Age incidence in ureteric stone cases shows that the percent age of paediatric, adult and old age group were 9.2, 73.9 and 16.9 percent respectively. It again the incidence is maximum in the adult age group and paediatric age group is rarely involved.

Age incidence in cases of vesical stones shows that the percentage was 44.8%, 31.3% and 23.8% cases in the paediatric, adult and old age group respectively. So maximum incidence of vesical stones occurs in the first decade of life.

The age incidence in urethral stone cases shows that maximum incidence occur in the paediatric age group.

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CONCLUSION

CONCLUSIONS

The following conclusions were drawn from this study.

1. The highest incidence of urinary calculi occurs in the month of June, July and August. This follows the maximum mean annual temperature by two months.
2. The lowest incidence of urolithiasis appears to occur simultaneously with the minimum mean annual temperature in this Bundelkhand region.
3. The relationship of humidity and urolithiasis is conflicting as higher the humidity more is the occurence of stone disease but lower himidity has no relationship with urolithiasis.
4. The highest incidence of urolithiasis occurs in the rainy seasch.
5. The maximum renal stone formation follows the maximum temperature period by two months. The maximum monthly renal stone cases occured in the month of June, July and August.
6. There is no definite relationship with the occurence or renal stones and lower atmospheric temperature in this region.
7. Higher humidity and more rainfall cases simultaneously increase in the occurence of renal stone cases.

8. The highest ureteric stone formation follows the maximum mean annual temperature by two to four months.

9. The lowest incidence of ureteric stone disease occurs simultaneously with the minimum mean annual temperature in this region.

10. The humidity does not has much significance on occurence of ureteric stones.

11. The highest incidence of vesical stones follows the maximum mean annual temperature by two months.

12. The lowest incidence of vesical stone cases occurs in the cooler months of the year.

13. Humidity and rainfal does not have much significance on the occurence of vesical stones.

14. The problem of recurrent and bilateral urinary stones should be investigated for hypercalcaemia and hyperclaciurea.

15. About five males are affected for every female in out study (5.4:1) of total urolithiasis. The sex distribution varies according to site of stones as male, female ratio in renal stones is about 4:1, in ureteric stones 4.4:1 in vesical stones 8.5:1 and in urethral stone 14:1.

16. We find age distribution in the paediatric age (⩽ 12 years) adult age (12 - 40 years) and old age (⩾ 40 years) as 25, 4%, 52.6% and 21.9% respectively in total urolithiasis.

17. Age incidence in renal stones cases only were 8.0%, 69% and 23% in paediatric, adult and old age group respectively.

18. Age incidence in vesical stone cases were 44.8% , 31.3% and 23.8% in paediatric adult and old age group respectively.

19. Highest incidence of urethral stone case were found in paediatric age group.

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BIBLIOGRAPHY

B I B L I O G R A P H Y

1. Prince C.L., Scardino, P.L. and Wolan, T.C.: The effect of temperature, humidity and dehydration on the formation of renal calculi. J. Urol, 75:209,1956.

2. Prince, C.L. and Scardino, P.L.: A statistical analysis of uretheral calculi. J. Urol 83:361, 1960.

3. Rivera, J.V.: Urinary calculi in Puerto RICO II seasonal incidence. Bul. Assoc. Med. Puerto Rico 65:28, 1973.

4. Bateson, E.H.: Renal tract calculi and climate. Med. J. Aust. 2: 111, 1973.

5. Elliott, J.P. Jr.: A stone season A ten year retrospective study of 768 surgical stone cases with respect to seasonal variation J.Urol 114:574, 1975.

6. Perry, E.S. and Lister, I.S.: Sunlight and hypercalciurea Lancet 1:1065, 1975.

7. Anderson, D.A.: Environmental factors in the etiology of urolithiasis in urinary calculi, 1973.

8. Blacklock, N.J.: The pattern of urolithiasis in the Royal Navi. In Hodgkinson, A., and Nordin, B.E.C. (Edi): Renal stone research symposium, P. 33. London, J. & A. Churchill Ltd, 1969.

9. Boyce, W.H., Garvey, F.K. and Strawcutter, H.E.: Incidence of urinary calculi among patients in general hospital 1948-1952, JAMA 161, 1437, 1956.

10. Burkland, C.E., and Rosenberg, M.: Survey of urolithiasis in uinted states. J. Urol. 73:198, 1965.

11. Finlayson, B.: Symposition on renal lithiasis. Renal lithiasis in review. Urol, Clin, N. Am. 1:181, 1974.

12. Gutman, A.B. and Yu T.F. uric acid repprolithiasis, Am. J. Med. 45:756, 1968.

13. Hazarika, E.A. and Rao, B.N.: Spectroclomical analysis of urinary tract calculi. Indian J. Med. Res. 62:776, 1974.

14. Herbstein, F.N., Kleeberg, J., Shalitin, Y. et al.: Chonical & X-ray difraction analysis of urinary stones in Israel. Jsr. J. Med. Sci. 10:1493,1974.

15. Hodgkinson, A. and Marshall, R.W. Charges in the composition of urinary tract stones. Invest. Urol. 13:131, 1975.

16. Lonsdale, K. Epitaxy as a growth factor in urinary calculi & Gall stones. Nature, 217:56, 1968.

17. Mates, J.: External factors in the genesis of urolithiasis Renal stone research symposium p 59,1969.

18. Modlin, M.: The aetiology of renal stone: A new concept orising from studies on stone free population. Ann, R. Coll. Surg. Engl. 40:155,1967.

19. Pantonawitz, D. Pollen, I.J., Polatzev, W.M. et al ureteric calculi: S. Aft. Med. J. 47, 128, 1973.

20. Rose, G.A. and Westbury, G.J.: The influence of calcium contest of water, intake of vegetable and fruit and of other food factors upon the incidence of renal calculi urol. Res., 3:61,1975.

21. Sutor, D.J., Wooley, S.E. and Ellingworth, J.J. A geographical & historical survey of the composition of rurinary stones. Br. J. Urol., 46:393, 1940.

22. Thomas, W.C. Jr.: Clinical concept of renal calculus disease. J. Urol., 113:423, 1975.

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